AMENDMENTS IN THE TITLE:

TRACKING CONTROL APPARATUS AND METHOD, ~~FOCUS CONTROL APPARATUS AND METHOD,~~ AND SIGNAL PROCESSING APPARATUS

AMENDMENTS IN THE DRAWINGS:

Please delete Fig. 2

AMENDMENTS IN THE SPECIFICATION:

Page 1, Line 9 (Paragraph beginning thereat):

The present invention relates to a tracking control apparatus and method which allow improving a precision of tracking control, ~~a focus control apparatus and method which allows improving a precision of focus control,~~ and a signal processing apparatus.

Page 5, line 14 (Paragraph beginning thereat) **through** Page 18, Line 15.

~~As in the circuit for detecting tracking errors, in a circuit for detecting focus errors, the received light quantity detection section may also be shared by an RF signal system and a focus error detection system in order to reduce the size and the cost of an optical head. In such a case, a response frequency of the received light quantity detection section becomes high. Thus, A high frequency component from tens of MHz to hundreds of MHz such as the modulation component of laser power is superimposed on the focus error signal.~~

Usually, the tracking error signal ~~and a focus error signal~~ passes through a low-pass type filter called an antialiasing filter for digital control. Thus, high-frequency components of the tracking error signal ~~and the focus error signal~~ are removed by the antialiasing filter. Therefore, even though the above-mentioned high-frequency component is superimposed on the tracking error signal ~~or the focus error signal~~, this does not cause any problem.

However, as power of laser for recording has increased for increasing the speed of the recording operation, it has become more apparent that it is necessary to account for influence of the above-mentioned high-frequency component on the tracking control ~~or the focus control~~ though the experiments of the present inventors.

This is because it was found that the above-mentioned high-frequency component saturate the operational circuits, and the amplitude of the tracking error control ~~and the focus control error~~ which passes through the antialiasing filter becomes small, causing a control loop gain to be lowered and unstable.

The object of the present invention is to provide a tracking control apparatus and method which allow improving a precision of tracking control, ~~a focus control apparatus and method which allows improving a precision of focus control,~~ and a signal processing apparatus.

DISCLOSURE OF THE INVENTION

A tracking control apparatus in an optical disc apparatus for performing reproduction for an optical disc capable of reproduction-only and performing recording/reproduction for an optical disc capable of recording/reproduction, according to the present invention comprises: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc; moving means for moving the optical beam spot in a radial direction of the recording surface of the optical disc; photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal; a filter section including a plurality of low-pass filters, in which each of the plurality of low-pass filters removes a component having a frequency equal to or higher than a predetermined cutoff frequency from a corresponding received light quantity signal among a plurality of the received light quantity signals output from the photodetection means; a switching section for selectively outputting one of a plurality of signals output from the low-pass filters and a plurality of signals output from the plurality of areas of the photodetection means; a tracking error detection section for generating a tracking error signal indicating an

amount of deviation of the optical beam spot from a track to be scanned on the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from ~~the filter section~~ the switching section; and a tracking control section for driving the moving means such that the optical beam spot follows the track on the recording surface of the optical disc in accordance with the tracking error signal, thereby achieving the above-described object~~.~~, wherein the switching section provides the signals output from the photodetection means to the tracking error detection section when an optical disc inserted into the optical disc apparatus is the optical disc capable of reproduction-only, and provides the signals output from the filter section to the tracking error detection section when an optical disc inserted into the optical disc apparatus is the optical disc capable of recording/reproduction.

~~A band control section for controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.~~ The optical disc capable of reproduction-only may be a DVD (Digital Versatile Disc)-ROM and/or a finalized DVD-R and/or a finalized DVD+R and/or a finalized DVD-RW and/or a finalized DVD+RW and/or a BD (Blu-ray Disc)-ROM and/or a HDDVD (High Definition DVD)-ROM.

~~The filter section may further include a plurality of equalizers, each of the equalizers may amplify a component of a predetermined frequency band included in a corresponding received light quantity signal among the plurality of the received light quantity signals output from the photodetection means, the optical disc apparatus may further include a switching section for selectively outputting one of a signal output from the low-pass filter and a signal output from the equalizer, the switching section may provide the signal output from the switching section to the tracking error detection section as the signal output from the filter section.~~

The switching section may provide the signal output from the low-pass filter to the tracking error detection section when the optical disc apparatus is in a recording operation state with respect to a recordable optical disc, and may provide the signal output from the equalizer to the tracking error detection section when the optical disc apparatus is in a reproduction operation state with respect to an optical disc of a reproduction-only type.

A focus control apparatus according to the present invention comprises: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc; moving means for moving the optical beam spot in a direction substantially perpendicular to the recording surface of the optical disc; photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal; a filter section including a plurality of low-pass filters, in which each of the plurality of low-pass filters removes a component having a frequency equal to or higher than a predetermined cutoff frequency from a corresponding received light quantity signal among a plurality of the received light quantity signals output from the photodetection means; a focus error detection section for generating a focus error signal indicating an amount of deviation of the optical beam spot from the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from the filter section; and a focus control section for driving the moving means such that the optical beam spot follows the recording surface of the optical disc in accordance with the focus error signal, thereby achieving the above-described object.

A band control section for controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.

A tracking control method according to the present invention is a tracking control method performing tracking control by using a tracking control apparatus included in an optical disc apparatus for performing reproduction for an optical disc capable of reproduction-only and performing recording/reproduction for an optical disc capable of recording/reproduction, wherein the tracking control apparatus includes: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc, moving means for moving the optical beam spot in a radial direction of the recording surface of the optical disc; and photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal, the tracking control method comprising the steps of: using a filter section including a plurality of low-pass filters to remove a component having a frequency equal to or higher than a predetermined cutoff frequency from each of a plurality of the received light quantity signals output from the photodetection means; generating a tracking error signal indicating an amount of deviation of the optical beam spot from a track to be scanned on the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from ~~the filter section~~ the photodetection means when an optical disc inserted into the optical disc apparatus is the optical disc capable of reproduction-only; ~~and~~ generating a tracking error signal indicating an amount of deviation of the optical beam spot from a track to be scanned on the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from the filter section when an optical disc inserted into the optical disc apparatus is the optical disc capable of recording/reproduction; and driving the moving means such that the optical beam spot follows the track on the recording surface of the optical disc in accordance with the tracking error signal, thereby achieving the above-describe object.

~~The step of controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.~~

~~The steps of: using the filter section including a plurality of equalizers to amplify a component of a predetermined frequency band included in each of the plurality of the received light quantity signals output from the photodetection means; and selectively outputting one of a signal output from the low-pass filter and a signal output from the equalizer as the signal output from the filter section may be further included.~~

~~The signal output from the low-pass filter may be output as the signal output from the filter section when the optical disc apparatus is in a recording operation state with respect to a recordable optical disc, and the signal output from the equalizer may be output as the signal output from the filter section when the optical disc apparatus is in a reproduction operation state with respect to an optical disc of a reproduction-only type.~~

~~A focus control method according to the present invention is a focus control method performing focus control by using a focus control apparatus, wherein the focus control apparatus includes: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc, moving means for moving the optical beam spot in a direction substantially perpendicular to the recording surface of the optical disc; and photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal, the focus control method comprising the steps of: using a filter section including a plurality of low-pass filters to remove a component having a frequency equal to or~~

~~higher than a predetermined cutoff frequency from each of a plurality of the received light quantity signals output from the photodetection means; generating a focus error signal indicating an amount of deviation of the optical beam spot from the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from the filter section; and driving the moving means such that the optical beam spot follows the recording surface of the optical disc in accordance with the focus error signal, thereby achieving the above-describe object.~~

~~The step of controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.~~

A signal processing apparatus according to the present invention is a signal processing apparatus used in a tracking control apparatus included in an optical disc apparatus for performing reproduction for an optical disc capable of reproduction-only and performing recording/reproduction for an optical disc capable of recording/reproduction, wherein the tracking control apparatus includes: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc, moving means for moving the optical beam spot in a radial direction of the recording surface of the optical disc; and photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal, the signal processing apparatus comprising: a filter section including a plurality of low-pass filters, in which each of the plurality of low-pass filters removes a component having a frequency equal to or higher than a predetermined cutoff frequency from a corresponding received light quantity signal among a plurality of the received light quantity signals output from the photodetection means; a switching section for selectively outputting one of a plurality of signals output

from the low-pass filters and a plurality of signals output from the plurality of areas of the photodetection means; a tracking error detection section for generating a tracking error signal indicating an amount of deviation of the optical beam spot from a track to be scanned on the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from ~~the filter section~~ the switching section; and a tracking control section for driving the moving means such that the optical beam spot follows the track on the recording surface of the optical disc in accordance with the tracking error signal, thereby achieving the above-describe object~~.~~, wherein the switching section provides the signals output from the photodetection means to the tracking error detection section when an optical disc inserted into the optical disc apparatus is the optical disc capable of reproduction-only, and provides the signals output from the filter section to the tracking error detection section when an optical disc inserted into the optical disc apparatus is the optical disc capable of recording/reproduction.

~~A band control section for controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.~~

~~The filter section may further include a plurality of equalizers, each of the equalizers may amplify a component of a predetermined frequency band included in a corresponding received light quantity signal among the plurality of the received light quantity signals output from the photodetection means, the optical disc apparatus may further include a switching section for selectively outputting one of a signal output from the low-pass filter and a signal output from the equalizer, and the switching section may provide the signal output from the switching section to the tracking error detection section as the signal output from the filter section.~~

~~The switching section may provide the signal output from the low-pass filter to the tracking error detection section when the optical disc apparatus is in a~~

~~recording operation state with respect to a recordable optical disc, and may provide the signal output from the equalizer to the tracking error detection section when the optical disc apparatus is in a reproduction operation state with respect to an optical disc of a reproduction-only type.~~

~~A signal processing apparatus according to the present invention is a signal processing apparatus used in a focus control apparatus, wherein the focus control apparatus includes: focusing means for forming an optical beam spot on a recording surface of an optical disc by focusing light beam on the recording surface of the optical disc, moving means for moving the optical beam spot in a direction substantially perpendicular to the recording surface of the optical disc; and photodetection means having a light receiving surface for detecting light reflected off the optical disc, in which the light receiving surface is separated into a plurality of areas, and each of the plurality of areas is formed to generate a received light quantity signal in accordance with a received light quantity and to output the received light quantity signal, the signal processing apparatus comprising: a filter section including a plurality of low-pass filters, in which each of the plurality of low-pass filters removes a component having a frequency equal to or higher than a predetermined cutoff frequency from a corresponding received light quantity signal among a plurality of the received light quantity signals output from the photodetection means; a focus error detection section for generating a focus error signal indicating an amount of deviation of the optical beam spot from the recording surface of the optical disc by performing a predetermined calculation with respect to a plurality of signals output from the filter section; and a focus control section for driving the moving means such that the optical beam spot follows the recording surface of the optical disc in accordance with the focus error signal, thereby achieving the above-describe object.~~

~~A band control section for controlling the filter section such that the predetermined cutoff frequency becomes small as a recording speed for recording information on the optical disc increases may be further included.~~

The optical disc apparatus according to the present invention includes a filter section for ~~remaining components necessary for tracking control or focus control and~~ removing ~~unnecessary~~ high-frequency band components immediately after a received detection section~~.~~, the filter is operated for a disc capable of recording/reproduction which does not require high-frequency band components when generating a tracking error signal, and the filter is not operated for a disc capable of reproduction-only which requires high-frequency band components. Thus, a ~~disturbance~~ unnecessary components due to modulation components of laser power (recording power) can be removed ~~from a tracking error signal or a focus error signal~~, while remaining components of the tracking error signal necessary for the tracking control. As a result, a precision of the tracking control or the focus control can be improved.

The optical disc apparatus according to the present invention is useful as a DVD multi-recorder, DVD multidrive or the like. Further, the present invention can be also applied to any type of optical disc apparatuses recording/reproducing multiple media, not limited to DVDs.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure **1** is a diagram showing a structure of the optical disc apparatus according Embodiment 1 of the present invention.

~~Figure 2 is a diagram showing a structure of the optical disc apparatus according Embodiment 1 of the present invention.~~

Figure **3** is a diagram showing a structure of a circuit for detecting tracking errors by using a phase difference method.

Figure **4** is a diagram showing a structure of a circuit for detecting tracking errors by using a push-pull method.

The description of the reference numerals are as follows:

1 Optical disc
2, 202 Laser diode
3, 203 Collimate lens
4, 204 Beam splitter
5, 205 Objective lens
6, 206 Received light quantity detection section
101 Lens driving section
102 Control signal generation section
103 Switching control section
104 Tracking error detection section
105 Switching section
106 Filter section
107 Band control section
108 Disc determination section
109 Management section
~~**207** Focus detection lens~~
~~**208** Lens driving section~~
~~**209** Control signal generation section~~
~~**210** Switching control section~~
~~**211** Focus error detection section~~
~~**212** Switching section~~
~~**213** Filter section~~
~~**214** Management section~~
301, 401 Received light quantity detection section
302, 303, 402, 403 Adder

304 Phase comparator
404 Subtracter

Page 34, line 8 (Paragraph beginning thereat) **through** Page 42, Line 24:

~~(Embodiment 2)~~

~~Figure **2** shows a structure of an optical disc apparatus according to Embodiment 2 of the present invention.~~

~~A laser diode **202** outputs laser light.~~

~~A collimate lens **203** converts the light output from the laser diode **202** into parallel light.~~

~~A beam splitter **204** transmits the parallel light from the collimate lens **203** through an objective lens **205**. The beam splitter **204** also separates parallel light from the objective lens **205** (light reflected off an optical disc 1) to a direction of a focus detection lens **207**.~~

~~The focus detection lens **207** has a lens structure for detecting focus errors by an astigmatism method from the parallel light passed through the beam splitter **204** and focus the light to a received light quantity detection section **206**.~~

~~The objective lens **205** focuses the parallel light passed through the collimate lens **203** and the beam splitter **204** to a recording surface of the optical disc 1 and forms an optical beam spot on the recording surface of the optical disc 1. Further, the objective lens **205** converts the light reflected off the optical disc 1 into parallel light and passes the parallel light through the beam splitter **204**.~~

~~A lens driving section **208** moves the optical beam spot formed by the~~

objective lens **205** in a direction substantially perpendicular to the recording surface of the optical disc **1**.

The received light quantity detection section **206** has a light receiving surface for detecting elliptical focus focused by the focus detection lens **207**. The light receiving surface is separated into four areas by two boundaries. Each of the four areas is formed to generate and output a received light quantity signal in accordance with a received light quantity. The received light quantity detection section **206** is formed such that one of two diagonal directions of the four areas matches the major axis elliptical focus and the other of the diagonal directions of the four areas matches the minor axis of the elliptical focus.

A filter section **213** has four sets of low-pass filters (LPF) and conductors. The LPFs remove components having frequencies equal to or higher than a predetermined cutoff frequency from a corresponding received light quantity signal from the four received light quantity signals output from four areas of the received light quantity detection section **206** and pass through other components. The conductors pass a corresponding received light quantity signal from the four received light quantity signals output from four areas of the received light quantity detection section **206** as it is. Further, each of the LPFs is formed such that it is possible to switch the cutoff frequency in accordance with a signal output from a switching control section **210**.

The switching control section **210** outputs signals to a switching section **212** and a filter section **213** in accordance with information indicating whether the optical disc apparatus is in a recording operation state or a reproduction operation and information indicating a recording speed (for example, rate for recording).

A management section **214** the information indicating whether the optical disc apparatus is in a recording operation state or a reproduction operation state and the information indicating a recording speed (for example, rate for recording), and

outputs the information to the switching control section **210**.

The switching section **212** has four selectors with two inputs and one output. The one selected from two inputs a and b of each of the selectors is connected to the output of the selector. Outputs of the LPFs are respectively connected to the inputs a of the selectors. Outputs of the EQs are respectively connected to the inputs b of the selectors. The LPF and the conductor connected to the inputs a and b of one selector is a set of LPF and conductor which receive the same received light quantity signal in the filter section **106**.

The switching section **212** switches the input of the selector to a or b at the same time in accordance with the signal output from the switching control section **210**.

The focus error detection section **211** generates and outputs a focus error signal indicating an amount of deviation of the optical beam spot from the recording surface of the optical disc **1**, based on four signals output from the switching section **212**.

A control signal generation section **209** outputs a focus control signal for making the optical beam spot formed by the objective lens **5** follow the track on the recording surface of the optical disc **1** in accordance with the focus error signal output from the focus error detection section **211**.

The lens driving section **208** moves the objective lens **205** in a direction substantially perpendicular to the recording surface of the optical disc **1** so that the optical beam spot follows the track on the recording surface of the optical disc **1** in accordance with the focus control signal output from the control signal generation section **209**.

As described above, the optical disc apparatus shown in Figure **2** function as a focus control apparatus which performs focus control.

The objective lens **205** functions as focusing means for forming the optical beam spot on the recording surface of the optical disc **1** by focusing light beam on the recording surface of the optical disc **1**. However, the focusing means is not limited to the objective lens **205**. Any one or more elements can be used as focusing means as long as they have a function similar to the function of the above-mentioned focusing means.

The lens driving section **208** functions as moving means for moving the optical beam spot formed by the objective lens **205** in a direction substantially perpendicular to the recording surface of the optical disc **1**. However, the moving means is not limited to the lens driving section **208**. Any one or more elements can be used as moving means as long as they have a function similar to the function of the above-mentioned moving means.

The received light quantity detection section **206** functions as photodetection means having the light receiving surface for detecting the light reflected off the optical disc **1**. The light receiving surface is separated into a plurality of areas. Each of the plurality of areas is formed to generate and output a received light quantity signal in accordance with received light quantity. However, the photodetection means is not limited to the received light quantity detection section **206**. Any one or more element can be used as photodetection means as long as they have a function similar as the function of the above-mentioned photodetection means.

It is not an essential feature for the present invention that the filter section **213** includes a plurality of conductors. As long as the filter section **213** includes a plurality of low-pass filters (LPFs) and each of the LPFs is formed to remove a component having a frequency equal to or higher than the predetermined frequency

from a corresponding received light quantity signal among the plurality of received light quantity signals output from the photodetection means, the optical disc apparatus including the filter section **213** is within the scope of the present invention. IF the filter section **213** includes a plurality of LPFs and does not include a plurality of conductors, the switching section **211** is not necessary. In such a case, outputs from the plurality of LPFs are provided to the focus error detection section **211** all the time. Alternatively, outputs from the plurality of conductors may be provided to the focus error detection section **211** all the time.

The focus error detection section **211** performs predetermined calculations with respect to the plurality of signals output from the filter section **213** to generate the focus error signal. How to generate the focus error signal is not important in the present invention. The focus error detection section **211** may generate the focus error signal by using any known method.

The control signal generation section **209** functions as a tracking control section for driving the lens driving section **208** such that the optical beam spot follows the recording surface of the optical disc **1** in accordance with the focus error signal.

The filter section **213**, focus error detection section **211**, and the control signal generation section **209** may be implemented by software by using computer programs or the like, or may be implemented by hardware by using circuits or the like. Alternatively, they can be implemented by the combination of software and hardware. The same is also true of the management section **214**, and switching control section **210**.

The lens driving section **208** may be, for example, a mechanical actuator.

An integration circuit may be formed by integrating at least the filter section **213**, focus error detection section **211**, and control signal generation section

209 on one semiconductor chip. Such an integration circuit functions as a signal processing apparatus for processing the focus error signal.

In the optical disc apparatus shown in Figure 2, the received light quantity detection section 206 is shared by an RF signal system and a focus control system in order to reduce the size and the cost of an optical head. RF signal is generated by a reproduction section which is not shown and recorded information is reproduced based on the four signals output from the received light quantity detection section 206.

The focus error is generated due to a non-planar surface of the optical disc, a shift in chucking, and the like. The frequency band is about several tens of kHz or lower in the case of DVDs. Thus, the frequency band of the received light quantity signal when being input to the focus error detection section 211 may be the band of several hundreds of kHz or lower. On the other hand, the response frequency of the received light quantity detection section 206 is high for generating the RF signal and includes laser power modulation component of few tens of MHz to several hundreds of MHz for recording.

As described with reference to Embodiment 1, the recording speed (for example, rate for recording) is different depending upon the intended purpose of the optical disc apparatus and the type of optical disc 1 mounted on the optical disc apparatus. This result in different focus control gains, frequency bands of the components required for the focus error signal, and the frequency band and the size of unnecessary components (particularly, modulation components of the laser power (recording power)). This is as described with reference to Embodiment 1 and the same is also true of the focus control system as the tracking control system.

Therefore, in the optical disc apparatus shown in Figure 2, the cutoff frequencies of the LPFs are made variable and the following operation is performed.

When the optical disc apparatus is in the recording operation state, the switching control section **210** outputs a signal to switching section **212** such that the selectors receives input from the inputs a. Further, the switching control section **210** outputs a signal for switching the cutoff frequencies of the LPFs to the filter section **213** such that, when the rate for recording is low, the cutoff frequencies of the LPFs are set to have high values, and, when the rate for recording is high, the cutoff frequencies of the LPFs are set to have low values.

Accordingly, when recording is performed, the laser power modulation components are always removed from the received light quantity signals when being input to the focus error detection section **211**. Therefore, the focus error detection can be normally performed without the influence of the laser power modulation component. As a result, focus control with a high precision can be performed even during a high-speed rotation.

In Embodiment 2, the focus error detection methods and the frequency bands have been described with reference to examples where the optical disc **1** is a DVD. However, the type of the optical disc **1** is not limited to the DVDs. Even when the optical disc **1** is an optical disc other than the DVDs, the present invention can be applied to any type of optical discs by appropriately adjusting the frequency bands.

Further, in Embodiment 2, the structure and operations of the optical disc apparatus have been described with reference to examples where the focus error method is an astigmatism method. However, the type of the focus error detection method is not limited to the astigmatism method. The present invention is not specific to a certain focus error detection method, but can be applied to any focus error detection method.

The switching section **212** may be omitted, and instead, the cutoff frequencies of the LPFs may be switched in accordance with the rate not only for

~~recording but also for reproduction. In this way, RF signal components included in the received light quantity signals (in the case of DVDs, the signal component from few MHz to several tens of MHz) can be removed with a high precision in accordance with the rate. Therefore, the focus error detection can be performed at a high precision even for reproduction, and focus control with a high precision can be performed.~~

Page 43, Line 8 (Paragraph beginning thereat):

The optical disc apparatus according to the present invention includes a filter section for ~~remaining components necessary for tracking control or focus control and~~ removing ~~unnecessary~~ high-frequency band components immediately after a received detection section~~.~~, the filter is operated for a disc capable of recording/reproduction which does not require high-frequency band components when generating a tracking error signal, and the filter is not operated for a disc capable of reproduction-only which requires high-frequency band components. Thus, ~~a disturbance~~ unnecessary components due to modulation components of laser power (recording power) can be removed ~~from a tracking error signal or a focus error signal~~, while remaining components of the tracking error signal necessary for the tracking control. As a result, a precision of the tracking control or the focus control can be improved.